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Mindfulness Practices and Attention Control in Early Childhood and Primary Education: A Review

Syeda Parsa Jarar[1]✉, Pratiwi Widyasari[2]
Department of Psychology, University of Indonesia, Depok, Indonesia[(1,2)]
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Abstract
Mindfulness-based interventions (MBIs) have gained recognition for enhancing attention control in early childhood education, helping students sustain focus, filter distractions, and regulate cognitive effort. While previous research highlights short-term benefits, gaps remain regarding long-term effectiveness, real-world implementation, and comparative efficacy against other attention-enhancing strategies. This review synthesizes findings on the impact of mindfulness on sustained, selective, and executive attention, bridging the gap between controlled experiments and classroom applications. A narrative review approach was employed, analysing peer-reviewed studies published between 2013 and 2024 from Medline, Google Scholar, ERIC, PsycINFO, and Scopus. Studies were selected based on predefined criteria; prioritizing research conducted in early educational settings. Findings indicate that mindfulness strengthens neural pathways related to executive function, leading to improved focus, impulse control, and cognitive flexibility. Programs like the Mindful Schools Curriculum and Kindness Curriculum have demonstrated positive effects, yet barriers such as teacher training gaps, limited classroom time, and intervention variability hinder widespread adoption. This review emphasizes the need for longitudinal studies, cross-cultural comparisons, and the integration of digital mindfulness tools. While mindfulness offers promise as an educational strategy, further research is required to assess its scalability and long-term impact on attention control and learning outcomes.

Keywords: *Mindfulness; Attention control; Early childhood; Primary education.*

✉ Corresponding author: Syeda Parsa Jarar
Email Address: email syedaparsa777@gmail.com (Depok, Indonesia)
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Introduction
Imagine a bustling classroom filled with the chatter of young students. Despite the lively environment, a small group sits quietly, focusing on their breathing in a brief mindfulness exercise. Moments later, they return to their activities with renewed focus and clarity. This scene reflects the growing integration of mindfulness in education as a strategy to improve attention management (Zelazo & Lyons, 2011).

Mindfulness, the practice of maintaining present-moment awareness in a non-judgmental way, has gained recognition for its ability to enhance both cognitive and emotional development. Research suggests that students who practice mindfulness strengthen their attention control, manage distractions more effectively, and navigate emotions with greater ease. This training helps the brain stay focused and reduces impulsive reactions to external stim Zenner uli—an essential skill in today's dynamic classroom settings(Bishop et al., 2004).

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As classrooms become increasingly fast-paced and technology-driven, attention control has emerged as a crucial factor in student learning and success. Mindfulness has been widely adopted in early childhood and primary education to help students develop foundational skills for focus, self-regulation, and cognitive flexibility(Davis, 2017). By equipping children with strategies to manage distractions and maintain sustained focus, mindfulness plays a vital role in supporting both academic and personal growth.

Attention control is not a singular skill but rather a combination of sustained attention, selective attention, and executive attention. Sustained attention enables students to focus on tasks over extended periods, such as listening to a story or solving a math problem. Selective attention allows them to filter out distractions and concentrate on important information, while executive attention helps them shift focus between tasks, regulate impulses, and manage cognitive effort efficiently(Deodhar & Bertenthal, 2023; Fisher et al., 2012).

Mindfulness directly supports these attention mechanisms by encouraging present-moment awareness. When students practice mindfulness, they learn to recognize when their focus drifts and gently bring their attention back to the task at hand. Research shows that mindfulness-based interventions significantly improve students' ability to concentrate on relevant information while ignoring distractions(Nieminen & Sajaniemi, 2016).

Mindfulness enhances attention control by fostering present-moment awareness, enabling students to recognize distractions and refocus on tasks(Simione & Saldarini, 2023). This practice reduces mind-wandering, strengthens meta-cognitive awareness, and improves sustained attention, leading to deeper engagement with learning material(Wunder & Jones, 2024). Empirical studies, including randomized controlled trials, confirm that mindfulness-based interventions (MBIs) significantly enhance students' focus and self-regulation. A longitudinal study by Zenner found that children who participated in an eight-week mindfulness program demonstrated greater sustained attention, improved classroom engagement, and higher task completion rates, reinforcing the real-world benefits of mindfulness beyond theoretical claims(Zenner et al., 2014).

Beyond experimental research, real-world applications such as the Kindness Curriculum and Mindful Schools Curriculum have shown that mindfulness improves academic performance, attention control, and classroom climate (Semple et al., 2010). Particularly beneficial for developing executive attention, mindfulness enhances students' ability to manage multiple tasks, regulate impulses, and shift focus efficiently(Crescentini et al., 2016). Malinowski further highlights how mindfulness-induced changes in the prefrontal and anterior cingulate cortex strengthen cognitive flexibility, making mindfulness a valuable tool for adaptability in learning environments(Malinowski, 2013).

Teachers who have introduced mindfulness programs report noticeable improvements in students' cognitive skills, emotional regulation, and peer interactions. These findings suggest that mindfulness offers a dual benefit—it not only enhances academic performance but also fosters a positive, collaborative classroom environment.(Kenwright et al., 2021; Thomas & Kumar, 2017)

However, while research extensively documents the cognitive benefits of mindfulness, many previous reviews have focused on controlled experimental settings, often neglecting its real-world implementation challenge(Bishop et al., 2004; Zelazo & Lyons, 2011). Few studies compare mindfulness with other attention-enhancing strategies, such as cognitive training, physical movement interventions, or metacognitive techniques (Zenner et al., 2014)Additionally, most research is short-term, assessing mindfulness over a few weeks or months, while its long-term impact remains uncertain.

This review critically examines the effectiveness, challenges, and future directions of mindfulness practices in early education by addressing key research gaps. It analyzes practical barriers to implementation, including teacher training gaps, time constraints, and cultural factors that may impact scalability. Additionally, it compares mindfulness with alternative attention-enhancing techniques to assess whether it is more effective on its own or should be

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combined with other strategies. The review also explores the need for long-term studies to determine how mindfulness influences sustained attention and academic success over time. Furthermore, it examines mindfulness as a tool for addressing digital-age attention challenges, particularly in mitigating the negative effects of excessive screen time on focus and cognitive overload(Vergara et al., 2020; Yakobi et al., 2021).

Neuroscientific research provides strong biological evidence for mindfulness's role in improving attention. Studies indicate that mindfulness strengthens the prefrontal cortex, responsible for sustained attention and impulse control, and the anterior cingulate cortex, which regulates cognitive flexibility and focus(Malinowski, 2013). These neural adaptations enhance students' ability to regulate their attention, filter distractions, and maintain cognitive engagement. Research on mindfulness-based programs, such as the Mindful Schools Curriculum, has demonstrated that even brief, daily mindfulness exercises significantly improve classroom focus and reduce behavioral interruptions. Similarly, Zsadanyi et al. found that mindfulness training helps develop neural pathways involved in executive function, allowing students to better manage distractions and regulate attention effectively(Zsadanyi et al., 2021).

To address these gaps, this review synthesizes recent studies from the past 10 years to provide an updated perspective on mindfulness in early education. By bridging the gap between research and practice, it offers practical recommendations for integrating mindfulness-based curricula into schools. It also highlights policy-driven approaches, advocating for teacher training programs, structured mindfulness curricula, and large-scale implementation strategies(Crane et al., 2016).

Despite its promise, scalability remains a challenge. While interventions like the Mindkeys Training Program (Suárez-García et al., 2020) and the Mindfulness-Based Kindness Curriculum(Haines et al., 2023) have demonstrated positive outcomes in different educational contexts, their long-term impact and adaptability across diverse student populations remain underexplored. Additionally, digital mindfulness tools present new opportunities for increasing accessibility, particularly in schools where teacher-led interventions are not feasible(Verhaeghen, 2021). These innovative solutions could help overcome resource constraints and expand mindfulness education to a wider audience.

This review synthesizes existing literature to provide a comprehensive understanding of mindfulness interventions in early education. By examining both theoretical insights and practical applications, it aims to bridge the gap between controlled research findings and real-world classroom implementation. It also explores mindfulness in comparison to alternative attention-enhancing techniques, offering a broader perspective on its effectiveness, adaptability, and sustainability in educational settings.

Furthermore, by analyzing recent studies from the past decade, this review provides insights for educators, policymakers, and researchers, helping shape future mindfulness-based curricula and intervention strategies in early childhood education.

Methodology

A narrative review approach was employed to examine the role of mindfulness practices in enhancing attention control among early childhood learners. This review aimed to synthesize existing literature on mindfulness-based interventions (MBIs) and their impact on attention regulation, focusing on key findings, theoretical perspectives, and practical applications in educational settings. To ensure comprehensive coverage, a systematic literature search was conducted across multiple databases, including Medline, Google Scholar, ERIC, PsycINFO, and Scopus. The search targeted peer-reviewed articles published between 2013 and 2024, incorporating foundational works where necessary to establish historical context and theoretical grounding. Studies were selected based on predefined inclusion and exclusion criteria to ensure methodological rigor and relevance.

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The review specifically included studies investigating MBIs implemented in early childhood educational settings, with a focus on their impact on sustained, selective, and executive attention. Only studies utilizing validated measurement tools, such as teacher reports, observational scales, or cognitive assessments, were considered. Preference was given to randomized controlled trials (RCTs), quasi-experimental studies, and qualitative research designs with robust analytical frameworks.

Following study selection, data extraction and synthesis were conducted to identify emerging themes and trends. Findings were categorized based on intervention type, participant characteristics, and attention control outcomes. Various mindfulness techniques, including breathing exercises, guided meditation, and classroom-based mindfulness training, were analyzed to assess their effectiveness in improving attentional control. Additionally, potential biases related to language restrictions, database coverage limitations, and variations in intervention structures were acknowledged to enhance transparency and credibility in the review process.

Result and Discussion

In modern educational settings, students face increasing challenges in sustaining attention and managing cognitive overload due to the abundance of distractions in learning environments. Addressing this issue, mindfulness has emerged as a promising approach for enhancing attentional control, cognitive engagement, and overall learning outcomes. Among the leading theoretical perspectives on mindfulness in education, Langer's research provides a foundational framework that emphasizes mindfulness as an active engagement process rather than a passive technique.

According to Langer, mindfulness involves anchoring attention in the present moment, allowing students to connect meaningfully with educational material, filter out distractions, and develop a flexible cognitive approach to learning. While Langer's work offers a compelling theoretical basis, it is primarily conceptual and relies heavily on illustrative examples rather than empirical studies. This creates a gap in understanding its practical applications and long-term effectiveness in real-world educational contexts(Ngnoumen & Langer, 2016).

Building on Langer's theoretical foundation, Felver and colleagues demonstrate how mindfulness-based interventions (MBIs) enhance cognitive functions, particularly conflict monitoring and sustained attention, among school-aged children. The study highlights that MBIs foster present-moment awareness, enabling students to identify distractions, maintain focus, and prioritize attention in challenging environments. These interventions improve the quality and duration of focus, contributing to academic success by strengthening attentional capacities and equipping students with tools to navigate distractions and build cognitive resilience(Felver et al., 2015). However, while Felver emphasized mindfulness's role in enhancing attentional stability, evidence from other studies suggests that its effectiveness may vary across different aspects of attention.

For instance, Carboni, Roach, and Fredrick investigated the impact of mindfulness training on elementary students diagnosed with ADHD, revealing that while mindfulness significantly improved on-task behavior and reduced hyperactivity, its effect on deeper attention-related issues remained limited. Pre- and post-test scores on the Attention Problems Scale showed minimal improvement, indicating that mindfulness alone may not fully address cognitive attention control challenges. These findings suggest that while mindfulness is beneficial for behavioral regulation, its cognitive impact may require longer and more structured interventions. Despite this, teachers found the training practical and effective, reinforcing the potential for mindfulness programs to be integrated into school curricula as a tool for attentional stability and classroom engagement(Carboni et al., 2013).

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Beyond its application to ADHD, mindfulness has also been examined in general student populations to assess its impact on cognitive development and retention. A study conducted in Siri Lanka by Karunananda, Goldin, and Talagala revealed that while students demonstrated moderate abilities in notetaking and retention, their mindfulness skills were significantly lower, highlighting a critical gap in cognitive development essential for effective learning. This study emphasized the foundational role of mindfulness in sustaining attention and reorienting focus, particularly in distraction-prone environments. However, like previous findings, the study noted limitations, such as a lack of large-scale longitudinal data and validated measures, restricting the generalizability of its findings. These findings reinforce the necessity of integrating mindfulness training into educational practices to enhance attention control and retention, with future research needed to assess its long-term impact on cognitive and academic performance(Karunananda, 2016).

In the context of early childhood education, Nieminen and Sajaniemi conducted a study in Finland and observed that mindfulness practices helped young learners sustain attention during structured classroom activities, such as story time and problem-solving tasks. Teachers reported that mindfulness practices helped children manage distractions during routine activities, suggesting that mindfulness interventions may serve as a preventive tool by equipping students with skills to handle distractions and maintain emotional stability in dynamic school settings. However, the study acknowledged limitations such as small sample sizes and inconsistent measures, emphasizing the need for larger-scale, rigorous studies to validate mindfulness's role in improving attention control and self-regulation(Nieminen & Sajaniemi, 2016).

Further supporting the role of mindfulness in executive functioning, an 8-week mindfulness program conducted by Rodriguez Vega and colleagues demonstrated notable improvements in participants' capacity to maintain attention on tasks and shift focus effectively when required. These skills are essential in high-stress environments, such as educational and professional settings. By fostering present-moment awareness, mindfulness allows individuals to navigate distractions, stay engaged with tasks, and enhance cognitive performance while promoting flexibility in thinking for better decision-making and problem-solving. However, despite these promising findings, further research is needed to assess mindfulness interventions across diverse contexts and over extended periods to validate their long-term benefits(Rodriguez Vega et al., 2013).

Rodriguez Vega's findings on cognitive resilience align with research by Morales-Urrutia, who examined mindfulness's role in primary education. Morales-Urrutia conducted an experiment with 137 children aged 10-12, integrating mindfulness practices into programming lessons with the emotional learning companion Alcody. Students who engaged in mindfulness activities reported higher programming scores, increased motivation, and improved focus compared to the control group. These findings further reinforce the idea that mindfulness reduces distractions, fosters cognitive engagement, and enhances task persistence in dynamic learning environments. However, the study had certain limitations, such as being conducted in a single school setting with limited cultural diversity, suggesting the need for broader research to generalize its findings(Morales-Urrutia et al., 2021).

Mindfulness interventions have been further explored in terms of their effects on selective attention. Kenwright's study found that mindfulness-based interventions improved students' ability to focus on relevant stimuli while disregarding irrelevant inputs, a finding supported by teachers who reported notable improvements in students' concentration and resistance to distractions after implementing mindfulness programs. These interventions enable learners to prioritize key information, a crucial skill in multi-stimulus educational settings. Additionally, mindfulness has been shown to foster emotional stability and better peer interactions, suggesting its dual benefit in supporting both academic performance and a healthier, more collaborative classroom atmosphere. These findings emphasize the role of

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educators as facilitators of mindfulness practices, ensuring that mindfulness is implemented in a structured and impactful manner(Kenwright et al., 2021).

Mindfulness interventions have also been successfully implemented in different countries. For example, in the United Kingdom, the Mindfulness in Schools Project (MiSP*)* has been widely adopted to support student well-being and academic engagement(Kuyken et al., 2013). In Canada, schools implementing Mindfulness-Based Stress Reduction (MBSR) programs have reported lower student stress levels and improved focus(Devcich et al., 2017). Similarly, in Australia, mindfulness-based curricula have been integrated into primary education, demonstrating positive effects on student attention, emotional regulation, and peer relationships(Waters et al., 2015). These international examples illustrate the scalability and effectiveness of mindfulness interventions in diverse educational settings.

Despite these promising outcomes, implementing mindfulness in real-world school settings presents challenges. A study by Tarrasch found that while mindfulness significantly improved attentional regulation, practical barriers such as classroom disruptions and minimal teacher training impacted its overall effectiveness. This suggests that successful mindfulness integration requires structured teacher training and consistent implementation strategies(Tarrasch, 2018). To enhance the impact of mindfulness interventions, schools should incorporate short daily mindfulness exercises, provide teacher training workshops, and integrate structured mindfulness curricula such as the Mindfulness-Based Kindness Curriculum (Haines et al., 2023).

While these findings highlight mindfulness's role in selective attention, its impact on higher-order cognitive abilities such as executive control and sustained attention requires deeper exploration. Research suggests that while mindfulness helps regulate focus, its effectiveness in broader cognitive functions varies depending on the structure and consistency of interventions. Yakobi's study found that while mindfulness had small but significant effects on sustained attention and executive control, its impact on working memory was non-significant. This suggests that mindfulness's effectiveness varies across different cognitive domains.

The study also emphasized that more structured mindfulness sessions yielded stronger outcomes, underscoring the importance of consistency in cognitive improvement. By fostering present-moment awareness, mindfulness enhances decision-making, task performance, and cognitive resilience in demanding environments. However, given the variability in intervention methodologies and the study's focus on healthy adults, its findings have limited generalizability to clinical or developmental populations. Nevertheless, this research strengthens the case for structured mindfulness programs as tools for enhancing attention regulation and executive control in high-demand environments(Yakobi et al., 2021).

A randomized controlled trial assessing the impact of a Mindfulness-Based Stress Reduction (MBSR) program for families in the United State demonstrated significant improvements in children's attention regulation. Participants in the intervention group showed enhanced performance in the Attention Network Task (ANT), particularly in conflict monitoring and orienting subsystems, indicating improved ability to prioritize cognitive resources and filter competing stimuli. These findings suggest that mindfulness enhances attentional self-regulation by helping children disengage from distractions and focus on present-moment tasks. While improvements in conflict monitoring were substantial, the study also noted marginal gains in alerting functions, indicating potential variability in how mindfulness impacts different components of attention regulation(Felver et al., 2015). Despite these promising outcomes, methodological concerns, such as small sample size and group-based intervention effects, highlight the need for larger-scale research to confirm these findings and address implementation challenges in diverse educational settings.

While mindfulness-based interventions have been widely studied for their role in enhancing attention control and executive functioning, recent research suggests that other cognitive training techniques may offer comparable benefits. A randomized controlled trial

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comparing mindfulness meditation (MM), heart rate variability biofeedback (HRV-BF), and physical exercise (PE) found that all three interventions significantly improved attention regulation, executive function, mindful awareness, and self-compassion. However, mindfulness meditation did not outperform the other two interventions, suggesting that biofeedback and physical exercise may serve as equally effective alternatives for improving cognitive functions. Interestingly, the HRV-BF group demonstrated lower effect sizes at follow-up, particularly for attention control and executive functioning, indicating that mindfulness and physical exercise might have more sustained benefits over time. These findings challenge the assumption that mindfulness is the most superior method for enhancing cognitive regulation and suggest that other physiological and attentional training techniques may yield comparable results. Further research is needed to explore how these interventions differ in mechanisms and long-term sustainability(de Bruin et al., 2016).

A comprehensive meta-analysis examining 87 studies on meditation and attention regulation found that mindfulness practices significantly improve various attentional processes, particularly in executive control and inhibition functions. The findings suggest that mindfulness-based techniques, including focused attention (FA) and open monitoring (OM), enhance cognitive flexibility by strengthening the ability to sustain attention and manage competing stimuli effectively. However, the meta-analysis also highlights variability in the effectiveness of mindfulness across different attentional subdomains. While mindfulness showed strong benefits for executive attention and inhibitory control, its effects on alerting attention were moderate, and it had limited impact on orienting attention, indicating that its benefits are more pronounced in tasks requiring top-down cognitive control rather than spatial attention shifts. These findings reinforce mindfulness as a valuable strategy for enhancing self-regulation and attentional engagement, though further research is needed to explore developmental differences in attentional benefits across different age groups(Sumantry & Stewart, n.d.).

Since structured mindfulness interventions have been shown to strengthen executive control, their impact on higher-order attentional mechanisms, such as executive attention, is particularly significant. Executive attention represents the most advanced level of attentional regulation, where students must effectively manage, shift, and allocate cognitive resources in response to academic and environmental demands. Fisher emphasizes that executive attention enables students to regulate competing demands, shift focus flexibly between tasks and optimize cognitive engagement. Unlike selective attention, which primarily filters distractions, executive attention prioritizes actions and adapts learning strategies in dynamic settings.

Mindfulness plays a crucial role in strengthening this ability by fostering emotional regulation, enhancing decision-making, and promoting adaptive responses to rapidly changing environments(Fisher et al., 2012). Furthermore, research by Crescentini et al. links mindfulness practices to enhanced neural activity in the prefrontal cortex, the brain region responsible for impulse control, task-switching, and executive functioning. This connection highlights how mindfulness-based interventions not only improve attentional flexibility but also enhance cognitive resilience. These findings reinforce the importance of structured mindfulness programs in equipping students with the cognitive tools needed to navigate complex academic and social landscapes(Crescentini et al., 2016).

Building on this, mindfulness-based interventions have been shown to enhance attention regulation and executive functioning, particularly among students with learning difficulties. A study on college students with executive functioning disorders found that mindfulness improved sustained attention, reduced distractibility, and strengthened cognitive flexibility, enabling students to focus on academic tasks with greater efficiency. Additionally, mindfulness practice enhanced metacognitive awareness, allowing students to monitor their learning processes and self-regulate distractions more effectively.

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These benefits contributed to improved goal setting, time management, and academic persistence, reinforcing the role of mindfulness in supporting cognitive control mechanisms necessary for success in high demand learning environments. However, the study emphasized that mindfulness alone may not be sufficient, suggesting that it should be paired with structured strategy instruction to yield long-term improvements in self-regulation and attentional control. These findings highlight the importance of integrating mindfulness within broader educational frameworks to maximize its impact on executive functioning and attention management(McCloskey, 2015).

Conclusion

This review highlights the growing evidence supporting mindfulness-based interventions (MBIs) as a valuable tool for enhancing attention control among early childhood and primary school students. Findings indicate that mindfulness practices improve sustained, selective, and executive attention, while also fostering self-regulation and cognitive flexibility. Neuroscientific research further supports mindfulness as a mechanism for strengthening prefrontal and anterior cingulate cortex functions, leading to better focus, impulse control, and cognitive adaptability in learning environments. Real-world applications, including structured mindfulness programs like the Mindful Schools Curriculum and the Kindness Curriculum, have demonstrated positive outcomes in both academic performance and classroom behavior. However, despite these promising findings, this review identifies several gaps that need further investigation.

The contribution of this review lies in its comprehensive synthesis of existing research, bridging the gap between controlled experimental findings and real-world classroom applications. By critically examining the effectiveness and challenges of mindfulness interventions, this study provides insights for educators, policymakers, and researchers in shaping evidence-based mindfulness curricula. Unlike prior reviews that primarily focus on short-term intervention outcomes, this review highlights the need for long-term studies to determine whether the benefits of mindfulness practices persist beyond early education. Furthermore, it emphasizes the importance of comparative research, evaluating mindfulness alongside other attention-enhancing techniques such as cognitive training, metacognition, and physical activity to assess its relative efficacy in diverse educational settings.

Despite its strengths, this review has certain limitations. The inclusion of only English-language studies presents a potential language bias, possibly excluding relevant findings from non-English sources. Additionally, the reliance on published peer-reviewed studies introduces publication bias, as studies with null or negative results may be underrepresented. The review also focuses primarily on qualitative synthesis, rather than a quantitative meta-analysis, limiting the ability to provide effect size comparisons across interventions. Furthermore, variability in mindfulness program structures and implementation fidelity across studies poses challenges in drawing uniform conclusions about effectiveness.

To advance research in this area, future studies should prioritize several key directions. Longitudinal studies are needed to assess the sustainability of mindfulness benefits over time and whether these improvements in attention control translate into long-term academic success. Additionally, cross-cultural comparisons should be conducted to evaluate how cultural factors influence the implementation and reception of mindfulness interventions in different educational contexts. Given the increasing prevalence of digital distractions, research should explore the integration of technology-based mindfulness interventions, such as mobile applications and virtual mindfulness programs, to determine their scalability and effectiveness in modern classrooms.

Overall, this review underscores the potential of mindfulness as an evidence-based educational strategy while acknowledging the practical challenges that must be addressed for widespread implementation. By encouraging rigorous research, policy support, and innovative intervention approaches, mindfulness can be further developed as a scalable and

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sustainable solution for enhancing attention control and cognitive engagement in early education.

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